

Code No: 115AE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, November - 2015

ELECTRICAL MACHINES – III  
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A (25 Marks)**

- 1.a) Explain pitch factor and winding factor. [2]
- b) Calculate pitch factor for the winding of 36 slots, 4 poles, coil span 1 to 8. [3]
- c) Why potier method of voltage regulation is accurate? [2]
- d) What is synchronous impedance method? [3]
- e) What is meant by synchronizing power? [2]
- f) What is meant by load sharing? [3]
- g) What is a synchronous condenser? [2]
- h) Why synchronous motor is not self starting? [3]
- i) Explain the principle of stepper motor. [2]
- j) Write the advantages of universal motor. [3]

**PART - B (50Marks)**

- 2.a) Give the constructional details of both salient pole and cylindrical rotor synchronous machines.
  - b) A three phase, 50 Hz Y connected alternator has a single layer winding distributed in 36 slots, each slot containing 16 conductors. The flux per pole is 0.04 wb. Calculate the terminal emf at open circuit. [5+5]
- OR**
- 3.a) List out the different types of armature windings of synchronous machine and explain briefly.
  - b) The phase EMF of a 3-phase alternator consists of fundamental, 20% of 3rd harmonic and 10% of fifth harmonic. The amplitude of fundamental is 1000 V. Calculate the RMS value of line and phase voltage, when the alternator is connected in (i) Star (ii) Delta. [5+5]
- 4.a) Explain the Experimental method of determining  $X_d$  and  $X_q$  (slip test) of a salient pole synchronous machine.
  - b) With neat phasor daigram explain Ampere Turn Method (M.M.F method). [5+5]

**OR**

- 5.a) Give the procedural steps to be followed for finding the voltage regulation of alternator using potier method.
- b) An 11 kV, 1000kVA, 3 phase, Y connected alternator has a resistance of 2 ohm per phase. The open circuit and full load full load zero power factor characteristics.

Field current	40	50	110	140	180
Occ line voltage	5800	7000	12500	13750	15000
Line volts zero pf	0	1500	8500	10500	12500

Find the voltage regulation of the alternator for full load current at 0.8 pf lagging by using potier method. [5+5]

- 6.a) How to determine the sub transient, transient and steady state reactance in an alternator.
- b) A 15 MVA, 11kV, 1500 r.p.m, 3 phase, 50 Hz alternator is connected to a large power system. Find synchronizing power per electrical degree of angular displacement at (i) no load and (ii) full load at rated voltage and current at 0.8 p.f. lagging. Also find synchronizing torque for a 0.5 degree mechanical displacement in each case. Take  $x_s=0.4pu$  [5+5]

**OR**

Explain the effect of change of excitation and mechanical power input of alternator when it is connected to Infinite bus bar.

- b) Two identical 3 MVA alternators are running in parallel. The frequency drops from no load to full load for the two alternators are 50Hz to 47 Hz and 50Hz to 48Hz respectively (i) How will they share a load of 4000 kW (ii) what is maximum load they can share at unity power factor without overloading any alternator? [5+5]
- 8.a) Draw and Explain the 'V-curves' and 'inverted V-curves' of synchronous motor.
- b) Explain the different starting methods of synchronous motor. [5+5]
- OR**
- 9.a) Derive the expression for mathematical analysis of power developed by synchronous motor.
- b) Explain the hunting of a synchronous machine. What is the purpose of damper Windings in a synchronous machine? [5+5]
- 10.a) Give the constructional features and explain the working principle of single phase induction motor and draw equivalent circuit.
- b) Compare the AC series motor with Universal motor and mention their operational difficulties. [5+5]
- OR**
- 11.a) Explain about capacitor start capacitor run motors of a single phase induction motor.
- b) Explain the working principle of permanent magnet motors. [5+5]